



UNIVERSITY OF  
MARYLAND



# **Computers and Computer Access**

## **Part II**

# **Computer Input and Output Options**

EDUC 477/6890

Devices Part IV-B



# Computer Input and Output Options



## Computer Input



# Computer Input



- Keyboard Adaptations
- Mouse Adaptations



# Computer Input



## Keyboard Adaptations

- There are several ways that we can adapt a keyboard.
- We can modify the keyboard by using an assisted keyboard
- Change to an alternative keyboard
- Emulating the keyboard.



# Computer Input



## Keyboard Adaptations

- **Assisted Keyboards**
  - **Repositioning keyboards**
  - **Keyguards**
  - **Key highlights**
  - **Software-based keyboard adjustments**



# Computer Input



## Keyboard Adaptations

- **Assisted Keyboards**
  - **Repositioning keyboards**

# Computer Input



- One of the simplest of assisted keyboards is to **reposition the keyboard**.

Probably for this reason, it is often overlooked as a keyboard adaptation.

Repositioning is important for users who use an extension devices (mouthstick, head pointer, light pointer, hand brace with pointing stick).

- Sometimes, repositioning the keyboard will alleviate the problem.



# Computer Input



## Keyboard Adaptations

- **Assisted Keyboards**
  - **Keyguards**



# Computer Input



- A keyguard is a protective cover for the keyboard with holes drilled to correspond to key locations.
- Keyguards give the user stability and allow them to accurately place their finger (or a pointing device) on the desired key.
- A keyguard may have holes for all the available keys or they may restrict the number of choices a user has available.
- In the latter case, the limited number of keys would allow a user with attention or memory difficulties to quickly identify the keys used in the program or activity.



**Visit the web sites of the following three vendors who manufacture keyguards: [Turning Point](#)**



# Computer Input



## Keyboard Adaptations

- **Assisted Keyboards**
  - **Key highlights**



# Computer Input



- **Highlighting keys** is typically used with persons who have a cognitive or visual impairment.
- For a person with a cognitive impairment, key highlighting is a process of marking important keys with a brightly colored sticker or symbol.





# Computer Input

## Highlighting Keys

- Often, a membrane or keyboard skin (plastic cover) is used to protect the keys and allow the therapist or job coach to quickly redesign the board without leaving a messy residue on the keys.
- This process often involves remapping the keyboard to disable undesirable keys that may interfere with the task at hand.
- For a person with a vision impairment, key highlights may involve using larger, higher contrast (e.g., white lettering on a black background) stickers or Braille markers.



# Computer Input



## Keyboard Adaptations

- **Assisted Keyboards**
  - **Software-based keyboard adjustments.**



# Computer Input



## Software-based keyboard adjustments

- Both Windows and the Macintosh operating systems include software-based adjustments for modifying the keyboard.
- These programs are included in the standard operating system and operate in the background.
- Typically, they work well for most all software.
- Some conflicts noted have been with programs that are not "mainstream" applications. .



# Computer Input



## Software-based keyboard adjustments

- Anything that works well with the Windows or Macintosh operating system seems to work well with these programs also.
- Go to each of the following sites to review these options



# Computer Input

## Software-based keyboard adjustments

- **Microsoft Corporation** (look for StickyKeys, FilterKeys, and ToggleKeys in this section)
  - Windows 95/NT
  - Windows 98
  - Windows 2000
  - Windows XP



# Computer Input



## Software-based keyboard adjustments

- **Apple Computer Inc** (look at StickyKeys, SlowKeys)
  - Accessibility Features



# Computer Input



## Software-based keyboard adjustments

- One Handed Keyboard
  - Half-QWERTY, one-handed keyboarding software



# Computer Input



- **Keyboard Adaptations**
  - **Ergonomic Keyboards**



# Computer Input

## Ergonomic Keyboards

- With the increasing incidence of repetitive strain injuries (RSIs), many manufacturers have been developing ergonomic keyboards.
- These keyboards are based on a standard keyboard layout but allow the user to reposition the keyboard in new and unique ways thus reducing the strain on the forearms, wrists, tendons, and fingers.



# Computer Input



## Ergonomic keyboards

- Come on all sizes, shapes, colors, and configurations.
  - [InfoGrip, Inc.](#)
- The link will take you to several representative types of ergonomic keyboards.



# Computer Input



- **Keyboard Adaptations**
  - **Alternative Keyboards**



# Computer Input



## Alternative Keyboards

- Designed to replicate the matrix of the standard keyboard, but in a nonstandard manner.
- Replace or operate in conjunction with the standard keyboard and compensate for problems of reduced key size or compact key arrangements (physical impairment), the use of abstract symbols (cognitive impairment), and the reduced size of key symbols (vision impairment).
- Can be generally grouped into four categories: **enlarged** keyboards, **mini** keyboards, **chordic** keyboards, and using **communication devices** as computer keyboards.



# Computer Input



- **Keyboard Adaptations**
  - **Enlarged Keyboards.**



# Computer Input

## Enlarged Keyboards

- Present the keyboard matrix in an enlarged format.
- Allow the individual to space keys widely apart to avoid multiple keystrokes,
- Remap the keyboard to an alternate matrix arrangement (ABC order),
- Increase the size of keyboard symbols to accommodate a user's limited vision

# Computer Input



## Enlarged Keyboards

- Foreexamples visit:
  - Intellikeys
  - Big Keys LX you will need to search
  - USB Kink
  - Discover Board



# Computer Input



- **Keyboard Adaptations**
  - **Mini Keyboards**



# Computer Input



## Mini Keyboards

- Smaller keyboards that accommodate a person using an extension device (head pointer, mouthstick) or who has a limited range of motion but excellent accuracy.
- Designed to reduce the fatigue and strain associated with locating and pressing keys traditionally presented over more expanded formats.
- Can be either stand alone or may require additional software/hardware combinations to drive their operation

# Computer Input

Visit to find out more about  
mini keyboards

- USB Mini by TASH, Inc.
- Magic Wand Keyboard.





# Computer Input



- **Keyboard Adaptations**
  - **Keyboard Emulation.**



# Computer Input



## Keyboard Emulation

- Also called “virtual keyboards”
- often used when persons who are unable to operate a standard, assisted, or alternative keyboard
- or in instances where a person fatigues quickly using more typical keyboarding methods
- mimics the input of a standard keyboard using an alternative input method.



# Computer Input



## Keyboard Emulation

- Four basic methods:
  - single switch scanning,
  - encoded input,
  - a touch window,
  - voice recognition.



# Computer Input



## Keyboard Emulation

- **Single/Multiple Switch Scanning and Encoded Input**
- Scanning is an indirect selection method.
- Using this method of computer input, a display of potential options is presented to the user.
- The user sends information (key strokes, commands, etc.) to the computer by using a switch as a signal when the choice is presented.
- Single/multiple switch scanning requires a software/hardware system to interpret switch signals.



# Computer Input



## Keyboard Emulation

### Single/Multiple Switch Scanning and Encoded Input

- **Encoded Input** allows the user to send information to the computer (input) using codes.
- Input method uses Morse Code as the coding system.
- Users send Morse Codes by pressing switches.
- Fast, efficient, and highly flexible system of entering information using switches



# Computer Input



## Keyboard Emulation

- Keyboard Emulation (Wisconsin Assistive Technology Alliance)
- Words +, Inc. search this site for information about EZ-Keys XP.



# Computer Input



## Keyboard Emulation

- The **TouchWindow** is a transparent, touch sensitive surface that fits over the computer screen. The user signals the computer by touching the relevant portion of the screen.
- To learn more about the **TouchWindow**, visit the [Edmark](#) site.



# Computer Input

## Keyboard Emulation

## Voice Recognition

- Becoming the most frequently used, major forms of keyboard emulation.
- Using voice recognition, a user speaks directly to the computer.
- A combination of hardware and software interprets the voice input and translates this input into letters, words, commands, and mouse commands.



# Computer Input



## Keyboard Emulation

## Voice Recognition

- Visit these sites to learn more about software for voice recognition:
  - [ScanSoft, Inc.](#)
  - [IBM](#)



# Computer Input



## Mouse Emulation

- Mouse emulation consists of having an alternative access method or device that mimics or replaces the standard mouse (Church & Glennen, 1991).
- For users who are unable to use the standard mouse due to a physical or cognitive disability, four alternatives exist:
  - trackballs or joysticks,
  - the numeric keypad,
  - alternative keyboards with built-in mouse functions, and
  - head mounted pointing devices.



# Computer Input



## About Mouse Emulation



# Computer Input



## Mouse Emulator

- Most problems are available in keyboard shortcuts (for example, to pull down a menu in MS Word, the user can press the ALT key and the first letter of the menu word).
- Many mouse access issues, especially for persons with visual impairment, can be alleviated in this manner.
- Keyboard shortcuts are often listed in the software manuals, but there are sites that list specific keyboard shortcuts.



# Computer Input



## Mouse Emulator

## Keyboard Shortcuts for Windows



# Computer Input



## Mouse Emulator

### Trackballs and Joysticks

- Often, persons with physical or cognitive disabilities can more effectively use pointing devices (like a mouse) if the standard mouse is replaced with a trackball or joystick.
- These devices allow the individual to interact with the computer in a more common manner.



# Computer Input



## Mouse Emulator

## Trackballs and Joysticks

- Visit these sites to see some commonly used joysticks and trackballs:
  - [Kensington Technology Group](#)
  - [Joystick Plus](#) by TASH, Inc.
  - [The Jouse](#)



# Computer Input

## Mouse Emulator

### Numeric Keypad as a Mouse

- Using the accessibility features of Easy Access and the accessibility features in Windows 95/98, users can transform the numeric keypad into a mouse emulator.
- When using the numeric keypad as your mouse, the 5 key issues button click commands, the 0 key is button down (click and hold), and the remaining numeric keys are directional keys to move the cursor around the screen.



# Computer Input



## Mouse Emulator

- **Microsoft Corporation** (look for MouseKeys in this section)
  - Windows 95/NT
  - Windows 98
  - Windows 2000
  - Windows XP



# Computer Input



## Mouse Emulator

- **Apple Computer Inc** (look at MouseKeys)
  - Accessibility Features



# Computer Input



## Alternative Keyboards with Mouse Functions

- Most alternative keyboards now include mouse functions in the standard layout.
- All mouse functions (click, double click, click and hold, and directional movement) can be controlled by the keyboard.



# Computer Input



## Head Mounted Mouse Emulation.

- For individuals with limited upper extremity control
- mouse functions controlled by head movements and single switch inputs.
- Head mounted mouse emulators are often paired with software programs that display the keyboard matrix on the computer screen.
- The user can then select the desired keystroke or command by pointing to the appropriate matrix location and signaling the computer with a switch.



# Computer Input

## Head Mounted Mouse Emulators:

- HeadMaster (click on "products", then again on "computer access")
- Tracker 2000 by Madentec. Click on "Tracker 2000" for information about on-screen keyboards
- Origin Instruments..
- The HeadMouse



# Computer Input



## On Screen Keyboards:

- WiViK Company.
- Madenta Click on "Screen Doors" for information about on-screen keyboards



# Computer Output



- **Monitor**



# Computer Output



## Monitor

- Difficulties with the monitor output are prevalent for persons with vision impairment and some individuals with cognitive impairment (that result in an inability to read).
- Monitor adaptations require equipment that augments existing sensory capabilities - hearing and/or residual vision.
- Monitor adaptations can be divided into devices that:
  - convert information to auditory formats,
  - enhance monitor images,
  - convert to visual information to a tactile format,
  - convert auditory alerting signals to visual signals



# Computer Output



## Monitor

### Auditory Formats

- Screen Reading programs allow the user to hear what is being presented on the screen with synthesized speech.
- These programs typically include an external or internal speech synthesizer and a companion software program.
- Have been designed to use standard multimedia cards (Sound Blaster, etc.) to produce the speech output.
- Some programs allow the user to hear only simple instructions while others will read all the screen information (including graphics if they are properly labeled).



# Computer Output



## Monitor

### Auditory Formats

- For a sample of text-to-speech synthesis, visit the [Speech Output](#). Other Read & Write/Screen Reader [Products](#)



# Computer Output



## Monitor

### Auditory Formats

- JAWS by Henter-Joyce (now Freedom Scientific)
- Ai Squared Go to "Products" then click on "ZoomText Plus"..



# Computer Output



## Monitor

### Enhanced Image

- Many people could read monitor output if the image were either magnified or the foreground/background colors were altered.
- Screen magnification typically allows the user to magnify the monitor image between 2 and 16 times its original size.
- Altering foreground/background colors is often available in standard programs such as word processors.



# Computer Output



## Monitor Magnification

- Accomplished through low tech or high tech methods.
- Simple **hand-held magnifiers** provide 2-8x enlargement of the viewing area.
- Some persons use these hand-held magnifiers to view monitor images.
- Companies, such as MaxiAids ([www.maxiaids.com](http://www.maxiaids.com)), sell **specific stand-alone magnifiers** for computer screens and televisions that provide moderate magnification without distortion.
- For individuals who need greater enlargement, **screen magnification programs** may be necessary.
- Lastly, **closed circuit televisions (CCTVs)** can be connected to the computer to produce magnified images.



# Computer Output



## Monitor Magnification

- Go to the [Large Print Programs page](#) of the Assistive Technology Online site for a summary of the more popular screen magnification programs.
- **Download demonstration** versions and try them on your computer.



# Computer Output



## Monitor Magnification

- For additional information about magnification programs, visit the following sites:
  - [Ai Squared](#) for ZoomText and VisAbility.
  - [Henter-Joyce, Inc.](#) for MAGic.





# Computer Output



## Monitor Magnification

- For additional information about closed circuit televisions, visit the following sites:
  - TeleSensory Corporation.
  - Human Ware
  - VTEK



# Computer Output



**Monitor**

**Convert to Tactile Formats**



# Computer Output



## Monitor

### Convert to Tactile Formats

- Information portrayed on the monitor converted to a tactile format.
- The most common form of tactile conversion is into Braille.
- Typically this requires a translation program (**Braille translator**) and a method of displaying the Braille information (a **Braille embosser** (printer) or a **refreshable braille display**).

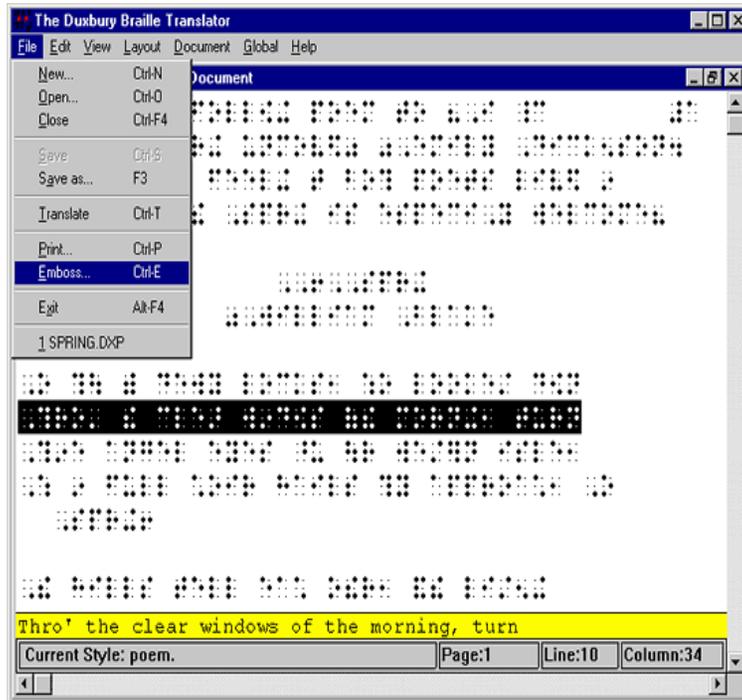


# Computer Output



## Monitor

## Convert to Tactile Formats



- **Braille translation programs**

- Duxbury Systems - Duxbury Brille Translator.& MegaDots Braille Translator



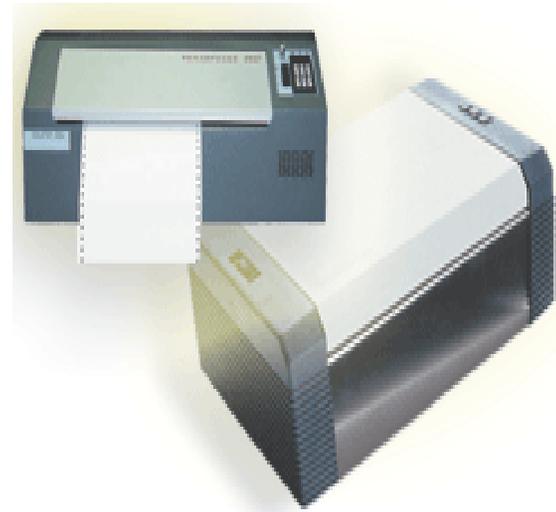
# Computer Output



## Monitor

### Convert to Tactile Formats

- **Braille embossers**  
(printers)
  - Freedom Scientific  
VersaPoint and the Braille Blazer.
  - Enabling Technologies.





# Computer Output



## Monitor

### Convert to Tactile Formats

- **Refreshable Braille displays**
  - Freedom Scientific.  
Click on "Braille Displays"





# Computer Output



## Monitor: Converting to Visual

- For some persons (with hearing impairments) the auditory beeps, quacks, and other sounds are missed.
- For example, when you make a mistake and press inappropriate keys, your computer will beep to let you know you performed an illegal operation.
- This signal is not accessible for persons with hearing impairments.
- Typically, individuals with hearing impairments will turn on the "**Show Sounds**" feature of the accessibility features in Windows 95/98 or turn the volume down to zero on the Macintosh operating system.
- With these features enabled, the screen (Windows) or menu bar (Macintosh) will flash whenever the computer emits an auditory signal.



# Computer Output



## Monitor: Converting to Visual

- **Microsoft Corporation** (look for Show Sounds or Visual Alerts in this section)
  - Windows 95/NT
  - Windows 98
  - Windows 2000



# Computer Output



## Monitor: Converting to Visual

- **Apple Computer Inc** (look at Visual Alerts)
  - Accessibility Features